SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts and Commercial Space Operations (2)

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INTELLECTUAL SYSTEMS OF DECISION-MAKING SUPPORT DURING THE CONTROL OF AUTOMATIC SPACE VEHICLES

Abstract

Based on control practice in a number of cases only the timely issue of direct execution instructions provides the flight programs. At the same time there is a need within strict time limitations in the recognition of the matter of a contingency, determination of the necessary control program and output it aboard of the SC. The quality of such tasks' solution considerably increases with the use of intellectual systems for decision-making support. The new structural construction of an intellectual system is suggested which includes an additional element - the unit of simulation and state prediction of SC equipment's state along with the traditional elements - the knowledge base and the inference machine. The knowledge base includes the data base and the set of decision rules. The data base is a software structure which contains event set S in the form of objects, attributes and their values. The decision rules S(U) set up logical correspondence between the states of onboard systems (events) and operation issues aimed at flight program performance (actions) as "if S, then U". Such correspondences are formed on the basis of spacecraft documentation as well as due to the creation of new combinations of operation issues. The unit of simulation and forecasting of the SC's operation is meant for the determination of standard characteristics of onboard systems' state under "ideal" execution of commands aboard the SC and their comparison to the real telemetry data. Conclusions on fulfillment of control programs of the SC and occurrence or absence of contingencies' signs are drawn as a result of comparison. The inference machine is intended for search and description of contingencies causes and methods of their elimination during the SC's flight. The essence of logical dependencies is an automated step-by-step search for the combinations of decision rules with a consequent prediction of onboard equipment's functioning state. The output data are the recommendations for control decision-making. The elements of intellectual novelty of the system are as follows: focusing the process of logical conclusions on the prescribed operation aims, the possibility of automated identification of newly occurred contingency cases and the acquisition of the knowledge base. The application of dynamic intellectual systems for the control of automated spacecrafts will provide the considerable backup for reliability growth and control efficiency of spacecrafts' operation.